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VOLUME 3

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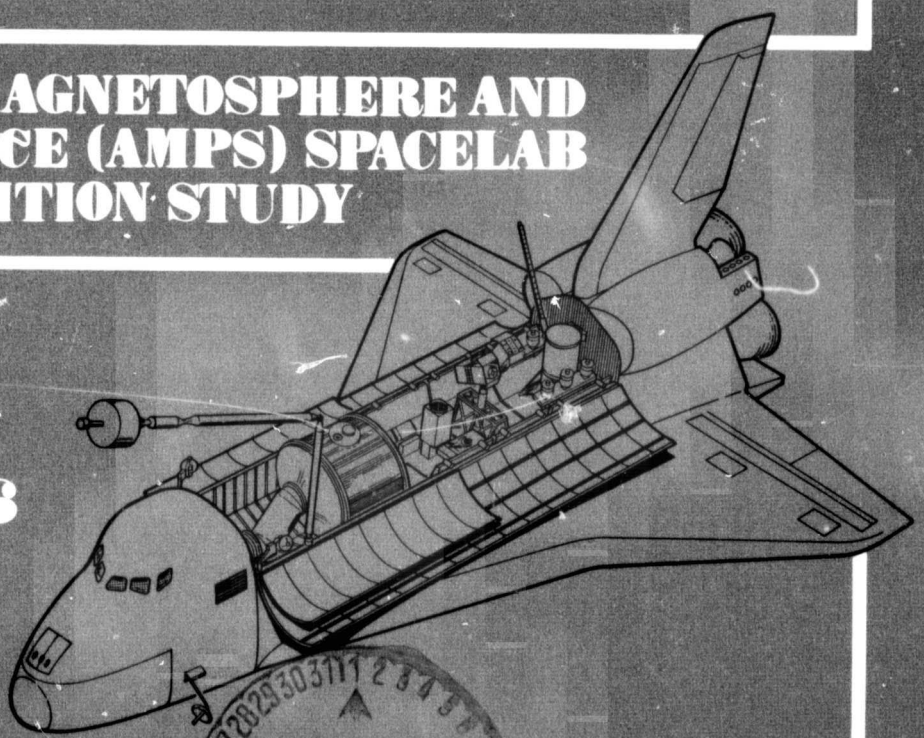
DR-SE-02A

INTERFACE CONTROL DOCUMENTS (ICD)

BOOK 3 - AMPS EQUIPMENT TO INSTRUMENTS ICD

ATMOSPHERE, MAGNETOSPHERE AND PLASMAS IN SPACE (AMPS) SPACELAB PAYLOAD DEFINITION STUDY



Final Report
November 1976

Prepared for
National Aeronautics
and Space Administration
Goddard Space Flight Center
Greenbelt, Maryland 20771

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DEFENSE AND SPACE SYSTEMS GROUP

ATMOSPHERE, MAGNETOSPHERE AND PLASMAS IN SPACE (AMPS)
SPACELAB PAYLOAD DEFINITION STUDY
FINAL REPORT

VOLUME III
BOOK 3 - AMPS EQUIPMENT TO INSTRUMENTS (VECTOR MAGNETOMETER) ICD

Document No.
27615-6007-RU-03
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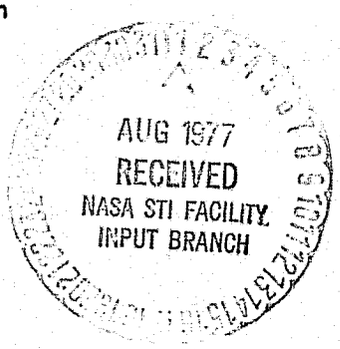

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CONTENTS

1. SCOPE

This document establishes the electrical, mechanical, and environmental interfaces between the boom-mounted flux gate magnetometer and the AMPS/Spacelab. General interface requirements, common to all experiment equipment, are given in the Labcraft Instrument Systems General Specification (27615-6007-RU-05). Where the requirement or a particular interface parameter is omitted from this document, the General Specification requirement shall apply.

2. APPLICABLE DOCUMENTS

2.1 OVERRIDING DOCUMENTS. The current issues of the following documents are applicable to the extent necessary to specify AMPS scientific instruments interfaces:

(a)	ESTEC/MSFC SLP-2104	Spacelab Payload Accommodations Handbook
(b)	GSFC XXX.XXXX	Mission Support Requirements Document
(c)	GSFC XXX.XXXX	AMPS/Orbiter Interface Control Document
(d)	GSFC XXX.XXXX	AMPS/Spacelab Interface Control Document.

In the event of conflict between these documents and this ICD the above references shall have precedence.

2.2 REFERENCE DOCUMENTS

2.2.1 Program level documents

TBD

2.2.2 Labcraft system requirements. The current issue of the following document is applicable in its entirety. In the event of conflict between this interface control document and the referenced specification, this interface control document shall govern:

2.2.2.1 GSFC XXX.XXX Labcraft Instrument Systems General Specification.

3. REQUIREMENTS

3.1 MECHANICAL

3.1.1 Dimensions. The outside dimensions of the sensor and the electronics assembly shall be as specified in Figure 3.1.1-1 (TBD). The following interface data shall be indicated in this drawing:

(1) Mounting hole location and tolerance

(2) Connection location and keying

(3) Center of gravity location.

3.1.2 Mass properties

3.1.2.1 Weight

Electronics	(TBD) kg
Sensor (includes pigtail and thermal insulation)	(TBD) kg
Total	(TBD) kg (max)

3.1.2.2 Center of gravity. The center of gravity location of the instrument will be as indicated in Figure 3.1.1-1. The center of gravity locations will be as follows:

Electronics:

$a = (TBD) \pm (TBD)$

$b = (TBD) \pm (TBD)$

$c = (TBD) \pm (TBD)$.

Sensor:

$a = (TBD) \pm (TBD)$

$b = (TBD) \pm (TBD)$

$c = (TBD) \pm (TBD)$.

3.1.2.3 Moments of inertia. The moments of inertia of the instrument about the center of gravity of the units shall be as follows:

Electronics:

$I_a = (TBD) \pm (TBD)$

$I_b = (TBD) \pm (TBD)$

$I_c = (TBD) \pm (TBD)$

Sensor:

I_a = (TBD) $\pm$ (TBD)

I_b = (TBD) $\pm$ (TBD)

I_c = (TBD) $\pm$ (TBD).

3.1.3 Mounting. The sensor and electronics package shall be secured as shown in Figure 3.1.1-1, and oriented as described in 3.1.4 below. The sensor shall be located on a boom which will extend the sensor so that it is at least (TBD) meters from the nearest structural element other than the boom itself.

3.1.3.1 Other instruments. Any other instruments or sensors which may be mounted on the boom structure must be designed so that the maximum magnetic field level at the magnetometer sensor location created by that instrument shall not exceed (TBD) gauss, and the maximum field distortion shall be less than (TBD) percent.

3.1.4 Sensor orientation. The fluxgate magnetometer sensor will be aligned with the aid of the GFE alignment fixture, which defines the directions of the sensor axes as shown in Figure 3.1.4-1 (TBD). Each of the axes' directions so defined shall be known to $\pm$ (TBD) degrees with respect to the boom-mounting platform. In flight, the orientation in Orbiter coordinates and in geomagnetic and geographic coordinates of each sensor axis shall be known to $\pm$ (TBD) degrees.

3.1.5 Viewing

None

3.1.6 Miscellaneous

3.1.6.1 Release mechanisms

3.1.6.2 Mechanisms - none

3.1.6.3 Other - none

3.2 ELECTRICAL INTERFACES

3.2.1 Electrical power The boom-mounted vector magnetometer will operate from the Spacelab power bus. A maximum of (TBD) watts of power at 28 ± 4 volts DC will be supplied to the magnetometer during instrument operation. During non-operating modes, the instrument requires thermal (heater) power as specified in 3.1.3.2.1.

3.2.1.1 Fault protection. The magnetometer includes TBD fault protection to limit the peak current drain to (TBD) amperes. This does not apply to transient loads which may reach (TBD) amperes for (TBD) seconds.

3.2.2 Input data. The magnetometer will require the following input signals for proper functioning.

3.2.2.1 Commands. The following command signals will be provided for magnetometer operation:

No	Command Description	Command Type	Command Frequency	Remarks
1	Power on-off	Pulse	TBD/hr	
2	Calibrate mode	Pulse		
3	Filter change	Pulse		
4	Range change	Pulse		

3.2.2.2 Reference and timing signals. The magnetometer shall receive reference signals from the Spacelab CDMS as defined in 4.4.2.1.3.1 of Reference 2.1(a).

3.2.3 Telemetry data. The magnetometer will produce two types of output data: sensor data and engineering or status data.

3.2.3.1 Sensor data. The data from the magnetometer will be transmitted on four coaxial cables representing the magnetic field signal level on each of three orthogonal axes plus a signal representing the vector sum of the three axis signals. Each signal will be as defined below:

No	Signal Ident.	Signal Type	Word Length (Bits)	Sample Rate (SPS)	Data Rate (BPS)
1	X-axis	*Serial digital	8	15	120
2	Y-axis		8	15	120
3	Z-axis		8	15	120
4	Total		8	15	120

*See Reference 2.1(a) for detailed definition..

3.2.3.2 Status data. Status data from the magnetometer will consist of the following signals:

No	Signal Ident	Signal Type	Work Length (Bits)	Sample Rate (SPS)	Data Rate (BPS)
1	Temperature	Serial digital	TBD	TBD	TBD
2	Range set	↓	↓	↓	↓
3	Filter set				
4	Drive on/off				
5	Boom deploy				
6	Other	TBD	TBD	TBD	TBD

3.2.3.3 Source impedance. The source impedance requirements for both digital and analog output signals will be specified in Appendix A of Reference 2.1(a).

3.2.3.4 Format assignment. The assignment of magnetometer data to specific telemetry channels is defined in Reference (TBD).

3.2.4 Connectors and cabling

3.2.4.1 Connector type. All electrical power and signal lines will interface with the magnetometer through a type (TBD) connector.

3.2.4.2 Connector pin assignment. The assignment of pins will be in accordance with Figure 3.2.4-1 (TBD).

3.2.4.3 Grounding and shielding. Grounding and shielding practices used in the magnetometer are indicated in Figure 3.2.4-1 (TBD) and are in accordance with the requirements of Appendix A of Reference 2.1(a).

3.2.4.4 Cable/wire type. The specific cable configuration and wire types to be used to interconnect the magnetometer and Spacelab are specified in Figure 3.2.4-1. The cable between the sensor and the electronics box will be provided as part of the instrument.

3.3 THERMAL

3.3.1 Temperatures

3.3.1.1 Operating limits. This instrument will be capable of operating over the following temperature range:

(a) Electronics (TBD) ^{o}C to (TBD) ^{o}C

(b) Sensor (TBD) ^{o}C to (TBD) ^{o}C.

3.3.1.2 Non-operating limits. The sensor can be stored or deployed in the non-operating mode over the following temperature range:

(a) (TBD) ^{o}C to (TBD) ^{o}C.

3.3.1.2.1 Electrical heater. An electrical heater and suitable thermostat control are provided to guarantee thermal survival of the magnetometer. The average power for this heater shall not exceed (TBD) watts and peak power shall be less than (TBD) watts.

3.3.2 Thermal load

3.3.2.1 Electronics. The average thermal load supplied by electrical power dissipation with the electronics unit is (TBD) watts.

3.3.2.2 Sensor. The sensor will dissipate electrical power in the form of thermal energy at the average amount of (TBD) watts.

3.3.3 Surface thermal properties

3.3.3.1 Mounting surfaces. Component mounting plates shall be flat to within ±(TBD) millimeters. The contact area of the electronics unit with its mounting plate shall be (TBD) square centimeters. The contact area of the sensor with its mounting plate shall be (TBD) square centimeters. The surface finish of the instrument mounting surfaces shall be (TBD). The instrument mounting surfaces shall be made of (TBD)

3.3.3.2 Non-mounting surfaces. The non-mounting surfaces of the instrument shall be made of (TBD). The surface finish of the instrument non-mounting surfaces shall be (TBD).

3.4 ELECTROMAGNETIC INTERFERENCE, NOISE, AND GROUNDS. No special requirements have been identified for this instrument.

4. HANDLING, SHIPPING, AND STORAGE

4.1 PHYSICAL HANDLING OF INSTRUMENT. This instrument shall be handled only when wearing clean nylon gloves. Grasping of the instrument by other than the housing shall not be permitted.

4.2 PROTECTIVE COVERS. This instrument employs a protective cover with the sensor. This cover shall remain in position during all systems tests except as directed by the Instrument Test Engineer.

4.3 RADIOACTIVE SOURCES. There are no radioactive sources associated with this instrument.

4.4 ORDNANCE DEVICES. There are no ordnance devices in this scientific instrument.

4.5 HUMIDITY

4.5.1 Purging. No gas purging is required of this instrument.

4.5.2 Excessive exposure. In the event of inadvertent exposure to greater than specified relative humidity, the instrument shall subsequently be subjected to an oven bakeout of at least TBD°C for 1 hour.

4.6 SHIPPING. Except when mounted on the Spacelab, this scientific instrument shall be transported in its custom carrying case. Movement of the instrument to and from the integration contractor will be the responsibility of NASA/GSFC.

4.7 STORAGE. At any time that the scientific instrument is removed from the SPACELAB/pallet it shall be placed in its custom instrument storage case.

5. NOTES

5.1 ABBREVIATIONS AND ACRONYMS. See 7.1 of 2.2.2.1.

5.2 DEFINITION OF TERMS. See 7.2 of 2.2.2.1.